



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

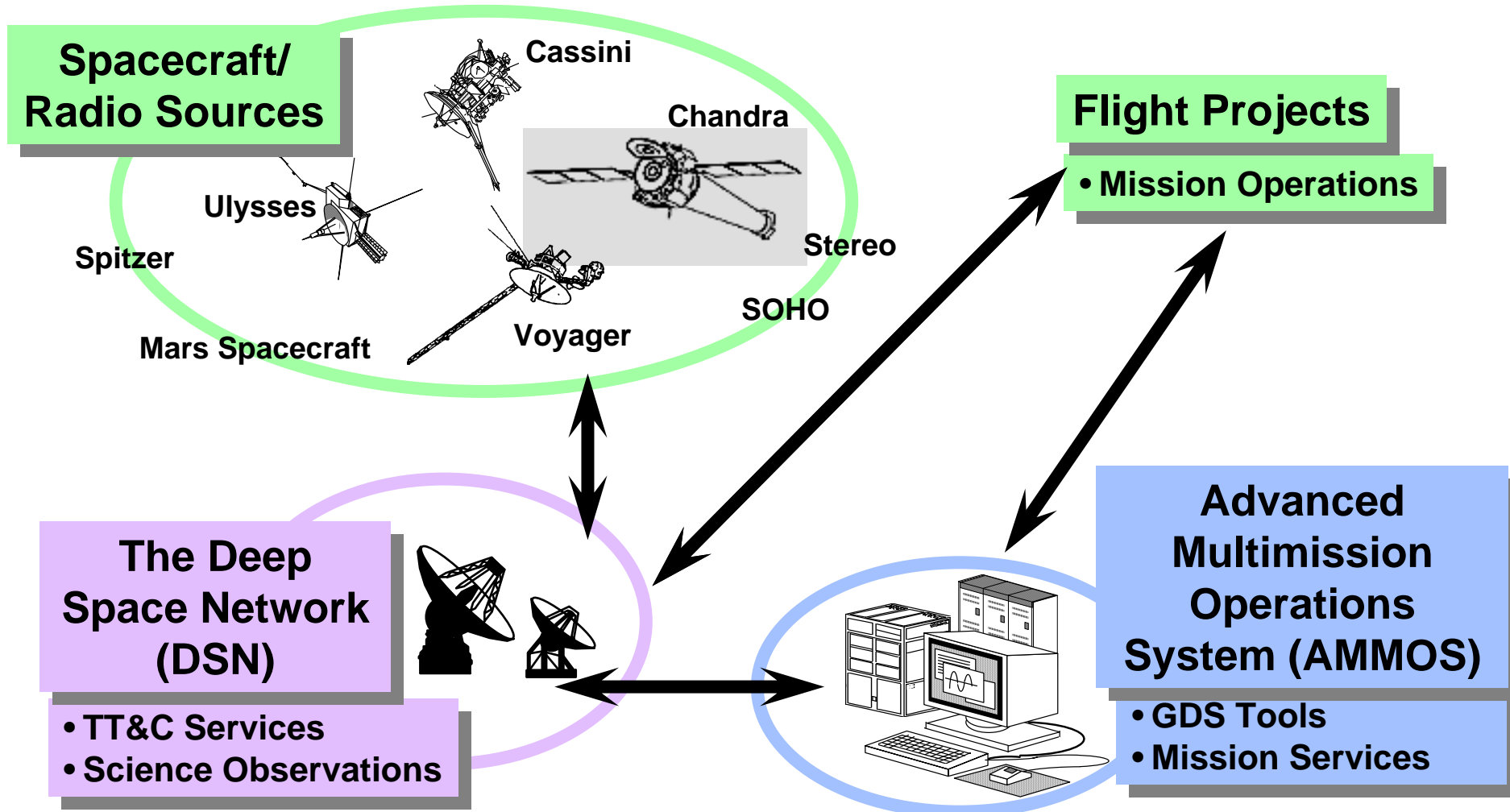
2006 NASA Safety Directors / Occupational Health Meeting

Ezra Abrahamy

DSMS Safety & Environmental Manager

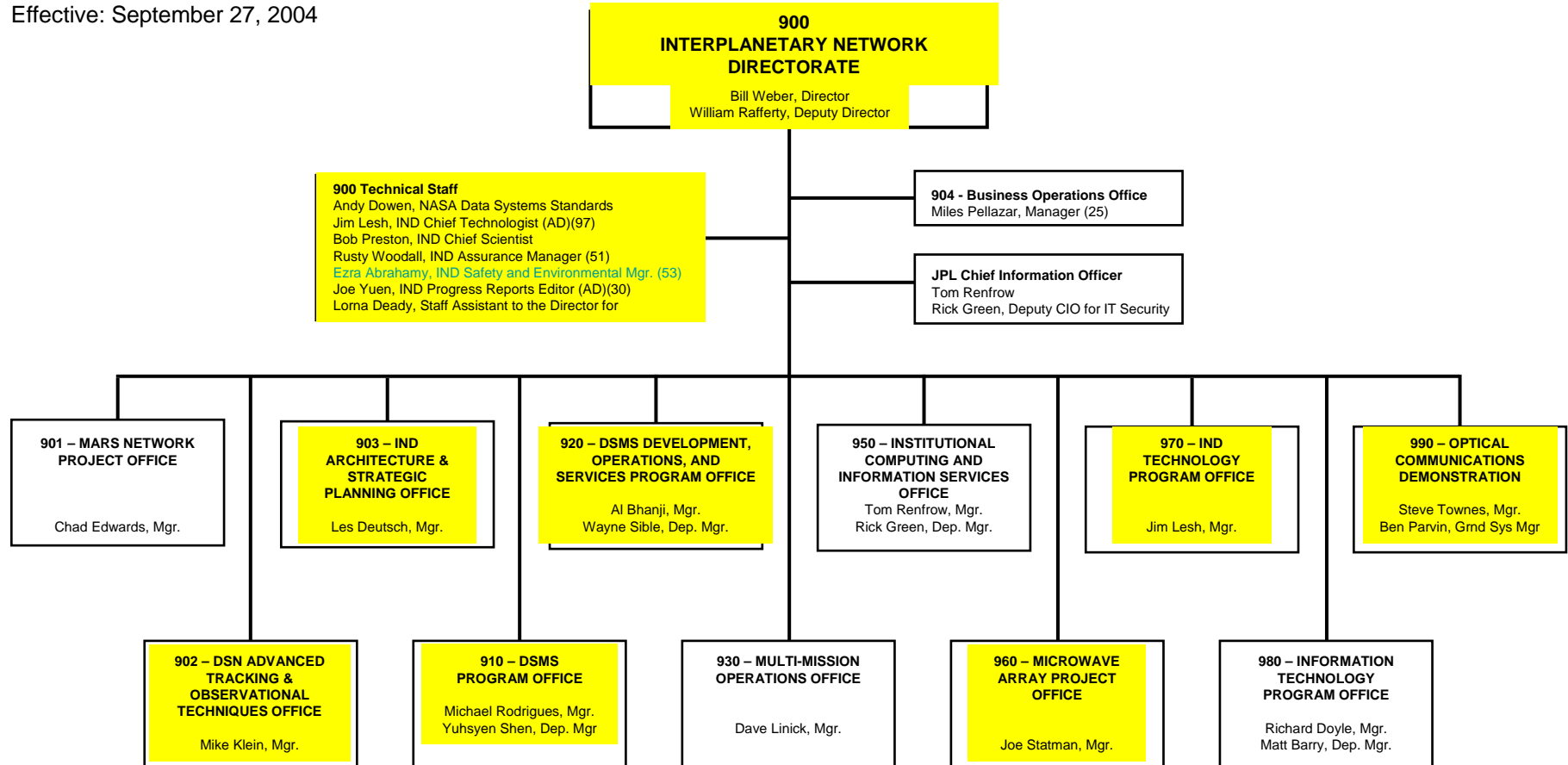


The DSMS Provides Services and Tools to Flight Projects



IND ORGANIZATION CHART

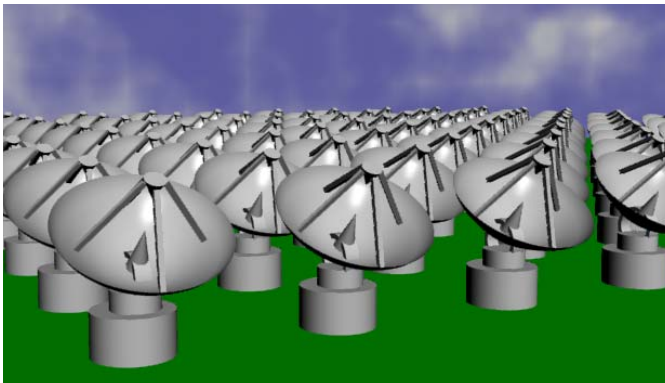
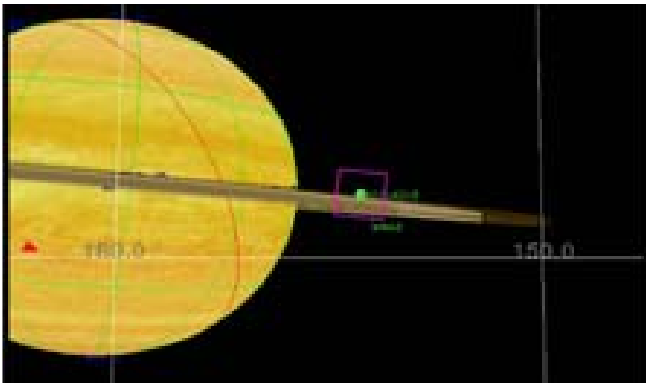
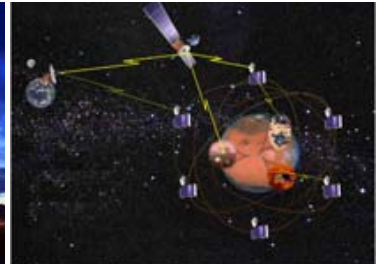
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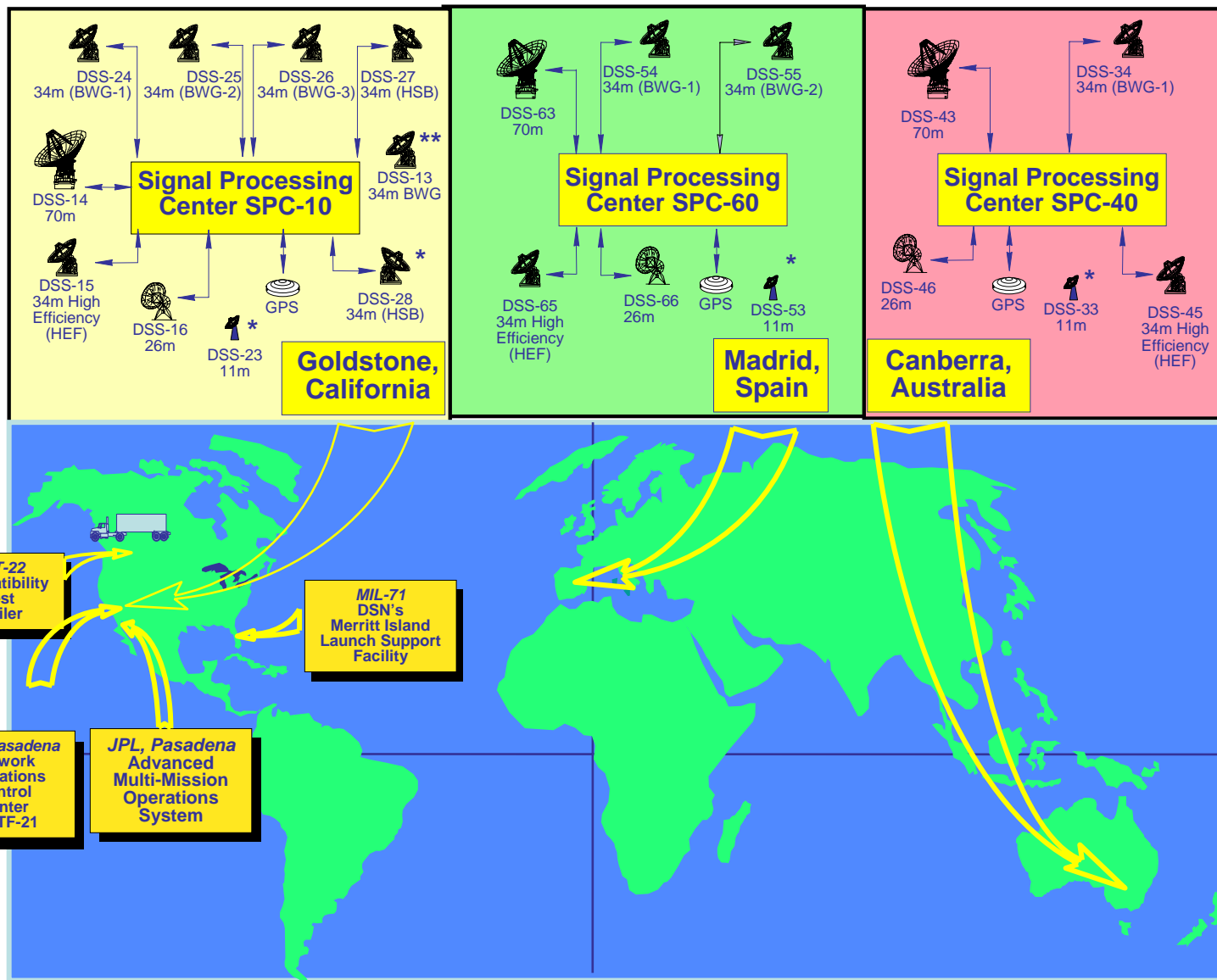
Jan 30 – Feb 2, 2006

EA-3

Deep Space Mission System (DSMS)



DSN Facilities



Jan 30 – Feb 2, 2006

EA-5

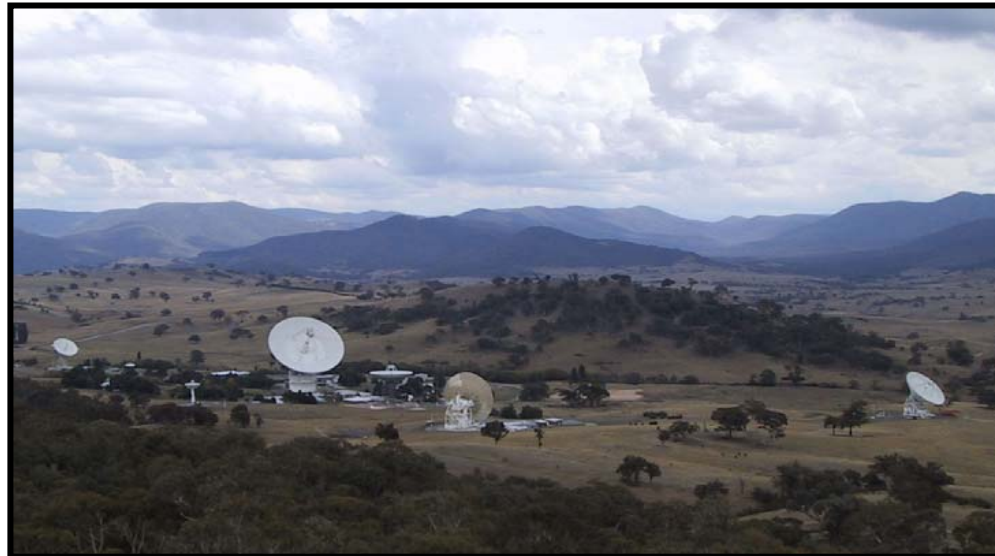
DSN Facilities - (World Wide)



Madrid
*Operated by INSA for
INTA*



Goldstone
*Operated by
ITT for
NASA/JPL*



Canberra
*Operated by
Raytheon
for CSIRO*

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Approved Mission Set: DSN Supports* (As of December 2005)

Legacy LEO

- RADARSAT (O)

LEOP**

- GOES N,O, P (C)
- NOAA N' (C)

HEO, Lunar, L1 & L2

- CHANDRA (O)
- WMAP (O)
- INTEGRAL (O)
- ISTEP-GEOTAIL (O)
- ISTEP-WIND (O)
- ISTEP-SOHO (O)
- ISTEP-POLAR (O)
- ACE (O)
- IMAGE (O)
- IMP-8 (O)
- ISTEP-CLUSTER II (O)
- ST-5 (C)
- SELENE (F)
- LUNAR-A (C)

DEEP SPACE***

- MARS GLOBAL SURVEYOR (O)
- CASSINI (O)
- STARDUST (O)
- 2001 MARS ODYSSEY (O)
- GSSR (O)****
- HAYABUSA (A.K.A., MUSES-C) (O)
- MARS EXPRESS (O)
- MER -- SPIRIT & OPPORTUNITY (O)
- ROSETTA (O)
- MESSENGER (O)
- DEEP IMPACT (O)
- MARS RECONNAISSANCE ORBITER (O)
- VENUS EXPRESS (O)
- DAWN (C)
- NEW HORIZONS (C)
- PHOENIX (C)
- JUNO (F)
- MARS SCIENCE LABORATORY (F)
- MARS SCOUT (F) (X)
- NEW FRONTIERS (F) (X)
- EVN (O)****
- GBRA (O)****
- SPITZER SPACE TELESCOPE (O)
- KEPLER (C)
- SIM (F)
- JWST (F)
- VOYAGERS 1 & 2 (O)
- ULYSSES (O)
- STEREO A & B (C)
- SPACE GEODESY (O)
- REFERENCE FRAME CALIBRATIONS (O)
- DISCOVERY (F) (X)
- MIDEX (F) (X)
- NMP (F) (X)

NOTES

*~21 additional spacecraft fall under "Emergency Support Only" and are not shown.

**LEOP = Launch & Early Orbit Phase; almost all DSN missions receive such support, but those listed as "LEOP" receive no other significant DSN support.

***Deep Space includes missions utilizing Earth leading and trailing orbits, since spacecraft in such orbits drift out well beyond Lagrange point distances.

****Support assumes the form of ground-based observations for mission reference ties (e.g., GP-B), VLBI geodetic observations, radio astronomy, solar system radar, or orbital debris.

KEY

- Universe
- Earth-Sun System
- Cross-Organizational Affiliation
- Solar System
- Earth-Sun-System-Related Non-NASA

(O) = Operating or utilizing ground-based observations in support of flight preparations (as of 12/05)

(C) = Commitment to support, but not yet operating (as of 12/05)

(F) = Future commitment to support anticipated (as of 12/05)

(X) = An as yet to be determined mission associated with an established Science Mission Directorate program line in which missions are competitively bid.

EA-7

Future U.S.-Led Deep Space Robotic Exploration & Science Missions *



UNIVERSE*

- GAMMA RAY LARGE AREA SPACE TELESCOPE
- WIDE-FIELD INFRARED SURVEY EXPLORER
- SPACE TECHNOLOGY 7**
- **KEPLER**
- SPACE TECHNOLOGY 8**
- NUSTAR

- **JAMES WEB SPACE TELESCOPE**
- **SPACE INTERFEROMETRY MISSION**
- **EXPLORER MISSIONS**

- **LISA**
- **TPF-C**
- **DISCOVERY MISSION**
- **CONSTELLATION-X**
- **EXPLORER MISSIONS**
- **TPF-I**

- **JDEM**
- **SAFIR**
- **INFLATION PROBE**
- **LARGE UV/OPTICAL OBS.**
- **BLACK HOLE FINDER PROBE**
- **BIG BANG OBSERVER**
- **BLACK HOLE IMAGER**
- **FIRSI**
- **LIFE FINDER**
- **EXPLORER MISSIONS**



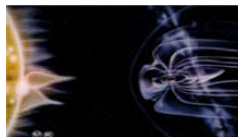
SOLAR SYSTEM*

- **DAWN**
- **PHOENIX**
- **NEW HORIZONS**
- **LUNAR RECONNAISSANCE ORBITER (LRO)**
- **MARS SCIENCE LABORATORY**

- **DISCOVERY MISSIONS**
- **RLEP #2**
- **JUNO**
- **MARS SCOUT #2**
- **MARS SCIENCE ORBITER**
- **MARS SCOUT #3**
- **NEW FRONTIERS #3*****

- **DISCOVERY MISSIONS**
- **OUTER PLANET-1**
- **MARS ASTROBIOLOGY FIELD LABORATORY**
- **MARS SCOUT #4**
- **NEW FRONTIERS MISSION #4*****
- **OUTER PLANET-2**
- **MARS SAMPLE RETURN (ORBITER +ERV)**

- **DISCOVERY MISSIONS**
- **LUNAR COM/NAV RELAY ORBITERS**
- **NEW FRONTIERS #5*****
- **MARS SAMPLE RETURN (MOBILE LANDER)**
- **MARS SCOUT #5**
- **MARS COMM/NAV RELAY #1**
- **VENUS SURFACE EXPLORER**
- **MARS COMM/NAV RELAY #2**
- **MARS HUMAN SUB-SCALE SCALEABLE TEST BED**
- **MARS HUMAN OUTPOST/HABITAT**
- **EUROPA ASTROBIOLOGY LANDER******
- **NEPTUNE SYSTEM MISSION******



EARTH-SUN SYSTEM*

- **TWINS B**
- **CLOUDSAT**
- **OCO**
- **GLORY**
- **AQUARIUS**
- **IBEX**
- **OSTM**
- **DSCOVR**
- **GOES N,O,P**
- **NOAA N'**
- **SPACE TECHNOLOGY 5****
- **STEREO A & B**
- **THEMIS**
- **AIM**
- **SDO**

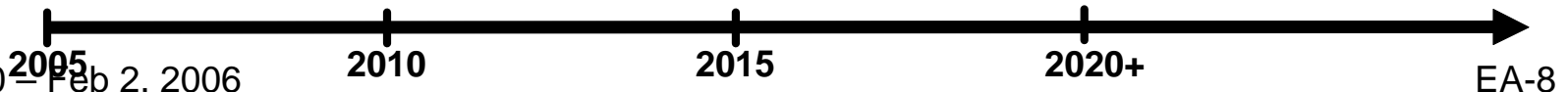
- **NPOES**
- **HYDROS**
- **GPM**
- **LDCM**
- **GEOSPACE RADIATION BELT MAPPER**
- **MAGNETOSPHERIC MULTI-SCALE**
- **SPACE TECHNOLOGY 9****
- **GOES-R**
- **INNER HELIOSPHERIC SENTINELS**

- **GEOSPACE ITM**
- **SOLAR PROBE**
- **DOPPLER**
- **GEMINI**
- **MAGCON**
- **GEOSPACE ELECTRODYNAMIC CONNECTIONS**

- **SOLAR WEATHER BUOYS/SEPP**
- **L1-EARTH-SUN**
- **HIGO**
- **AURORAL ACCELERATION MULTIPROBE**
- **ITM-WAVES**
- **TROPICAL ITM-COUPLER**
- **DAYSIDE BOUNDARY CONSTELLATION**
- **RECONNECTION AND MICROSCALE**
- **FARSIDE SENTINEL/SHIELDS**
- **MTRAP**
- **MARS ATMOSPHERIC RECONNAISSANCE SURVEY**
- **INNER MAGNETOSPHERIC CONSTELLATION**
- **SOLAR POLAR IMAGER/TELEMACHUS**
- **INTERSTELLAR PROBE**

Key

- **DSN Support Likely**
- **DSN Support Possible**
- **DSN Support Unlikely**



Very Approximate Launch Epoch

* Please see notes on attached page.

Significant Mission Events

December 2005 - January 2007

<u>MISSION</u>	<u>ACTIVITY/EVENT</u>	<u>DATE</u>	<u>SUBNET</u>	<u>CRIT LEVEL</u>
CASSINI	ORBIT TRIM MANEUVER #45	DEC 10, 2005	34-METER	3
MESSENGER	DEEP SPACE MNVR #1	DEC 12, 2005	34/70-METER	1
VOYAGER 1	DTR PLAYBACK ARRAY	DEC 21, 2005	34/70-METER	2
CASSINI	ORBIT TRIM MANEUVER #46	DEC 22, 2005	34-METER	3
CASSINI	TITAN-9 FLYBY	DEC 26, 2005	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #47	DEC 29, 2005	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #48	JAN 02, 2006	34-METER	3
STARDUST	MANEUVER TCM-18	JAN 5, 2006	70-METER	2
CASSINI	ORBIT TRIM MANEUVER #49	JAN 12, 2006	34-METER	3
STARDUST	MANEUVER TCM-19	JAN 14, 2006	34/70-METER	1
STARDUST	RELEASE EARTH ENTRY	JAN 15, 2006	34/70-METER	1
STARDUST	DIVERT MANEUVER	JAN 15, 2006	34/70-METER	1
STARDUST	CAPSULE ENTRY	JAN 15, 2006	34/70-METER	1
CASSINI	TITAN-10 FLYBY	JAN 15, 2006	34-METER	3
NEW HORIZONS	LAUNCH	JAN 17, 2006	34/26-METER	1
CASSINI	ORBIT TRIM MANEUVER #50	JAN 18, 2006	34-METER	3
NEW HORIZONS	TCM-1 (L+8 D)	JAN 25, 2006	34-METER	2
NEW HORIZONS	TCM-1 (L+10 D)	JAN 27, 2006	34-METER	2

Jan 30 – Feb 2, 2006

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CHANGE/ADDITION FROM LAST MONTH

** NO EARLIER THAN

*** POTENTIAL LAUNCH DATE

Significant Mission Events (Cont'd)

December 2005 - January 2007

<u>MISSION</u>	<u>ACTIVITY/EVENT</u>	<u>DATE</u>	<u>SUBNET</u>	<u>CRIT LEVEL</u>
MRO	TCM-3	FEB 01, 2006	34-METER	2
CASSINI	ORBIT TRIM MANEUVER #51	FEB 02, 2006	34-METER	3
DEEP IMPACT	SLEEP MODE CHECK UP (5 PASSES)	FEB 9-12, 2006	70-METER	3
NEW HORIZONS	TCM-2 (L+20 D)	FEB 10, 2006	34-METER	2
MESSENGER	TCM-10	FEB 22, 2006	34-METER	2
CASSINI	ORBIT TRIM MANEUVER #52	FEB 24, 2006	34-METER	3
CASSINI	TITAN-11 FLYBY	FEB 27, 2006	34-METER	3
MRO	TCM-4	FEB 28, 2006	34-METER	2
ST-5	LAUNCH	FEB 28, 2006	34/26-METER	1
CASSINI	ORBIT TRIM MANEUVER #53	MAR 01, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #54	MAR 05, 2006	34-METER	3
MRO	TCM-5A	MAR 09, 2006	34-METER	1
MRO	TCM-5B	MAR 10, 2006	34-METER	1
MRO	MARS ORBIT INSERTION	MAR 10, 2006	34-METER	1
CASSINI	ORBIT TRIM MANEUVER #55	MAR 15, 2006	34-METER	3
CASSINI	TITAN-12 FLYBY	MAR 19, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #56	MAR 21, 2006	34-METER	2

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CHANGE/ADDITION FROM LAST MONTH

** NO EARLIER THAN

*** POTENTIAL LAUNCH DATE

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Significant Mission Events (Cont'd)

December 2005 - January 2007

<u>MISSION</u>	<u>ACTIVITY/EVENT</u>	<u>DATE</u>	<u>SUBNET</u>	<u>CRIT LEVEL</u>
VOYAGER 1	DTR PLAYBACK ARRAY	MAR 31, 2006	34/70-METER	2
CASSINI	ORBIT TRIM MANEUVER #57	APR 05, 2006	34-METER	3
VEX	VENUS CAPTURE MNVR	APR 11 2006	70-METER	1
CASSINI	ORBIT TRIM MANEUVER #58	APR 26, 2006	34-METER	3
MESSENGER	TCM-11	SEP 13, 2006	34-METER	2
VOYAGER 1	DTR PLAYBACK ARRAY	APR 27, 2006	34/70-METER	2
CASSINI	TITAN-13 FLYBY	APR 30, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #59	MAY 03, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #60	MAY 07, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #61	MAY 17, 2006	34-METER	3
CASSINI	TITAN-14 FLYBY	MAY 20, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #62	MAY 23, 2006	34-METER	3
STEREO	LAUNCH	MAY 26, 2006	34/26-METER	1
STEREO	PERIGEE 1 TCM	TBD	34-METER	2
STEREO	PERIGEE 2 TCM	TBD	34-METER	2
STEREO	PERIGEE 3 TCM	TBD	34-METER	2
STEREO	PERIGEE 4 TCM	TBD	34-METER	2

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CHANGE/ADDITION FROM LAST MONTH

** NO EARLIER THAN

*** POTENTIAL LAUNCH DATE

Significant Mission Events (Cont'd)

December 2005 - January 2007

<u>MISSION</u>	<u>ACTIVITY/EVENT</u>	<u>DATE</u>	<u>SUBNET</u>	<u>CRIT LEVEL</u>
GOES-O	PROJECTED LAUNCH DATE	**APR 01, 2007	26-METER	1
CASSINI	ORBIT TRIM MANEUVER #63	JUN 07, 2006	34-METER	3
STEREO	LUNAR SWINGBY 1	TBD	34-METER	2
CASSINI	ORBIT TRIM MANEUVER #64	JUN 28, 2006	34-METER	3
CASSINI	DIONE FLYBY	JUN 30, 2006	34-METER	3
CASSINI	TITAN-15 FLYBY	JUL 02, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #65	JUL 05, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #66	JUL 10, 2006	34-METER	3
CASSINI	TELESTO FLYBY	JUL 10, 2006	34-METER	3
STEREO	LUNAR SWINGBY 2	TBD	34-METER	2
CASSINI	ORBIT TRIM MANEUVER #67	JUL 18, 2006	34-METER	3
CASSINI	TITAN-16 FLYBY	JUL 22, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #68	JUL 24, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #69	AUG 01, 2006	34-METER	3
MESSENGER	TCM-12	OCT 12, 2006	34-METER	2
CASSINI	ORBIT TRIM MANEUVER #70	SEP 04, 2006	34-METER	3
CASSINI	TITAN-17 FLYBY	SEP 07, 2006	34-METER	3

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CHANGE/ADDITION FROM LAST MONTH

** NO EARLIER THAN

*** POTENTIAL LAUNCH DATE

Significant Mission Events (Cont'd)

December 2005 - January 2007

<u>MISSION</u>	<u>ACTIVITY/EVENT</u>	<u>DATE</u>	<u>SUBNET</u>	<u>CRIT LEVEL</u>
CASSINI	ORBIT TRIM MANEUVER #71	SEP 10, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #72	SEP 14, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #73	SEP 20, 2006	34-METER	3
CASSINI	TITAN-18 FLYBY	SEP 23, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #74	SEP 26, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #75	OCT 01, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #76	OCT 06, 2006	34-METER	3
CASSINI	TITAN-19 FLYBY	OCT 09, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #77	OCT 12, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #78	OCT 17, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #79	OCT 22, 2006	34-METER	3
MESSINGER	VENUS-1 FLYBY	OCT 24, 2006	34-METER	2
CASSINI	TITAN-20 FLYBY	OCT 25, 2006	34-METER	3
CASSINI	TELESTO FLYBY	OCT 28, 2006	34-METER	3
CASSINI	ENCELADUS/CALYPSO FLYBY	NOV 09, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #80	NOV 09, 2006	34-METER	3
CASSINI	DIONE/TITAN FLYBY	NOV 21, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #81	NOV 26, 2006	4-METER	3

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CHANGE/ADDITION FROM LAST MONTH

** NO EARLIER THAN

*** POTENTIAL LAUNCH DATE

EA-13

Significant Mission Events (Cont'd)

December 2005 - January 2007

<u>MISSION</u>	<u>ACTIVITY/EVENT</u>	<u>DATE</u>	<u>SUBNET</u>	<u>CRIT LEVEL</u>
MESSENGER	TCM-13	DEC 01, 2006	34-METER	2
CASSINI	ORBIT TRIM MANEUVER #82	DEC 09, 2006	34-METER	3
CASSINI	TITAN-21 FLYBY	DEC125, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #83	DEC 15, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #84	DEC 20, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #85	DEC 25, 2006	34-METER	3
CASSINI	TITAN-22 FLYBY	DEC 28, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #86	DEC 31, 2006	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #87	JAN 05, 2007	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #88	JAN 10, 2007	34-METER	3
CASSINI	TITAN-23 FLYBY	JAN 13, 2007	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #89	JAN 15, 2007	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #90	JAN 21, 2007	34-METER	3
CASSINI	ORBIT TRIM MANEUVER #91	JAN 26, 2007	34-METER	3
CASSINI	TITAN-24 FLYBY	JAN 29, 2007	34-METER	3

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CHANGE/ADDITION FROM LAST MONTH

** NO EARLIER THAN

*** POTENTIAL LAUNCH DATE

EA-14

OCTL
(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- OCTL is a key JPL/NASA laser communications ground facility
- Located at the JPL Table Mountain Facility
- It is a prototype for safe laser beam propagation to space
- Developing techniques for a future network

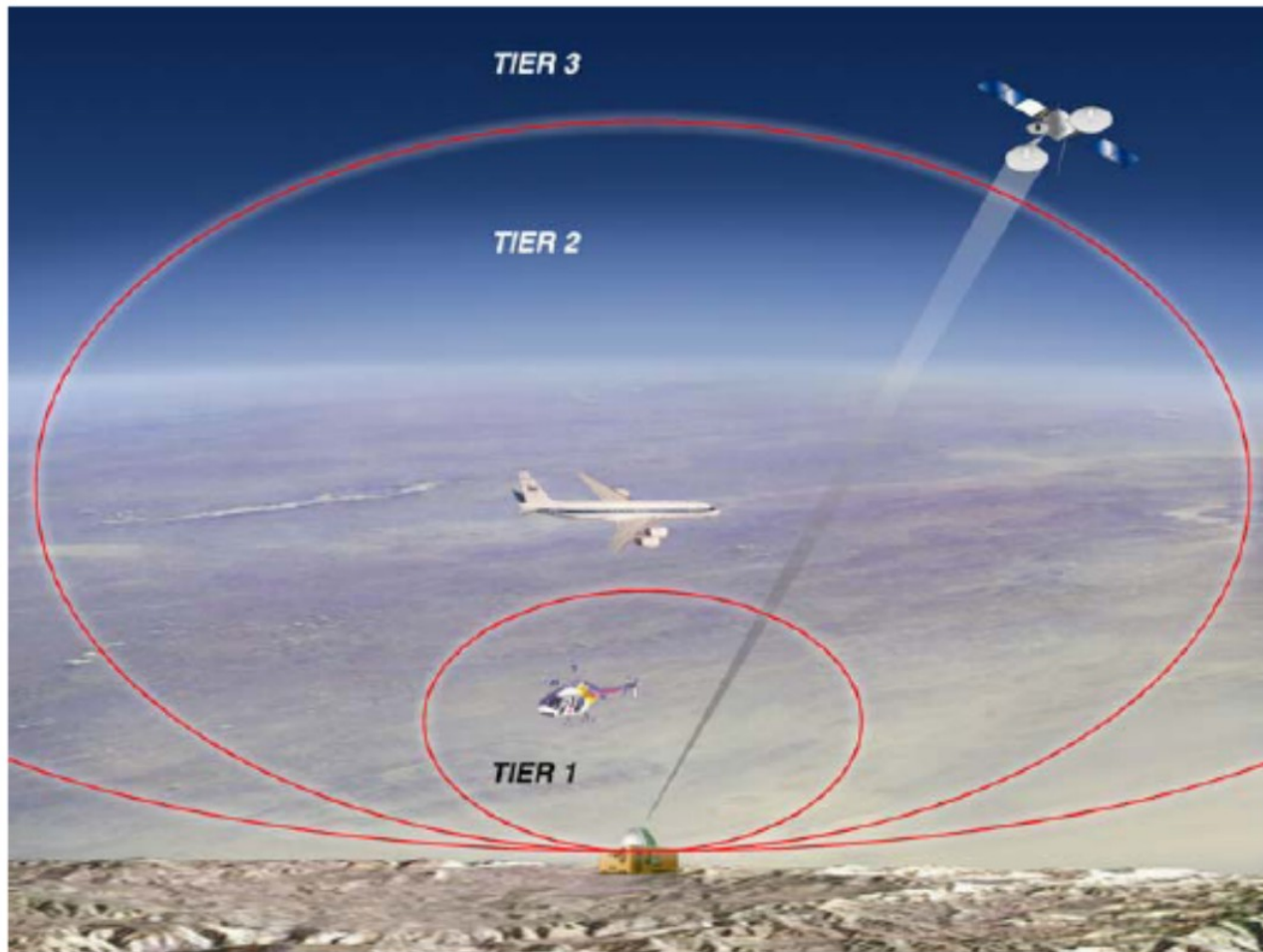
OCTL (Cont'd)
(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- Laser beam propagation between ground and space is regulated by several government agencies, including:
 - NASA
 - OSHA
 - FAA
 - US Space Command

OCTL (Cont'd)
(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- JPL has identified and defined a 4-tier safety system
 - We have divided the propagation space into three regions
 - The first region is internal to the OCTL and is designated Tier-0
 - The second region is the airspace beyond the telescope dome that is regulated by the FAA
 - This is further divided up into two levels
 - Tier-1 that extends from the telescope dome out to a radius of two miles
 - Tier-2 that relies on radar and extends to about 20 miles
 - The third region, Tier-3, is that regulated by the US Space Command at Cheyenne Mountain
 - It extends from near-Earth to the ranges of geo-stationary and high-elliptical orbiting satellites.

OCTL (Cont'd) **(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)** **AIRSPACE SAFETY SYSTEM DEVELOPMENT**



OCTL (Cont'd)
(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- **Tier-0**
 - Requirements include:
 - OSHA
 - JPL Rule Doc ID 45393
 - ANSI Z136.1 and Z136.6
 - Protection includes:
 - Install shielding around optical bench and beam traveling to/from telescope
 - Use of safety goggles by operators of laser system as well as posted hazard signs at entrance doors
 - Install safety- interlock system to preclude inadvertent entry to OCTL laser operation room
 - Install warning lights at entrances to operation room that flash when laser is powered on
 - Provide laser safety training of all personnel involved in the operation of facility

OCTL (Cont'd)
(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- **Tier-1**
 - Provides the needed detection capability for aircraft flying close to the terrain around the TMF including:
 - Helicopters
 - Fire-fighting aircraft
 - Gliders
 - Ultra-lights
 - Low-flying Air Force jets from Edwards Air Force Base
 - This is an optical detection system that is designed to detect such flying craft and to shutter the laser before the aircraft crosses the beam

OCTL (Cont'd)

(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)

AIRSPACE SAFETY SYSTEM DEVELOPMENT

- Tier-1 (Cont'd)
 - **This is designed around a thermal-IR detector array to meet the daytime and nighttime operations requirement**
 - Detection could be performed with a visible light camera system, assuming all aircraft use the FAA-mandated anti-collision strobe and/or wingtip navigation lights at night
 - There are instances in which a visible-light contrast reversal occurs or contrast is significantly reduced (e.g., dusk operations)
 - The long wave infrared (LWIR) camera system avoids this difficulty because the target always stands out as a bright source against the dark sky, regardless of illumination conditions
 - The LWIR system also is expected to have more ability to observe an aircraft through moderate levels of dust and haze, conditions occasionally encountered at the TMF site
 - Finally, the LWIR system has the advantage of not requiring aircraft lighting for detection at night, an added safety feature.
 - **To enhance the certainty of detecting all aircraft within the Tier 1 exclusion region, the system uses a pair of LWIR cameras based on the Raytheon Control IR 2000B barium strontium titanate (BST) focal plane array**
 - One camera is set to a narrow angle of view (9 degrees) while the other to a wide angle of view (35 degrees)
 - Both cameras are aimed at the same point in the far field, and the system is mounted to the telescope structure, bore-sighted to the center of the telescope field of view (FOV)
 - Once an aircraft is identified, it is tracked to determine its potential to intercept the beam. If the track comes sufficiently close to the beam, the algorithm interrupts the “all clear” signal, causing the shutter to close

OCTL (Cont'd)
(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- Tier-2
 - FAA approval for use of the Primus-40 system
 - Honeywell Primus–40 WXD weather radar is co-boresighted with the laser beam. The system detects aircraft out to 25-km and triggers a beam block interrupt whenever an aircraft is detected.
 - A radar display interface direct feed from the FAA is another method being explored for controlling laser beam operation

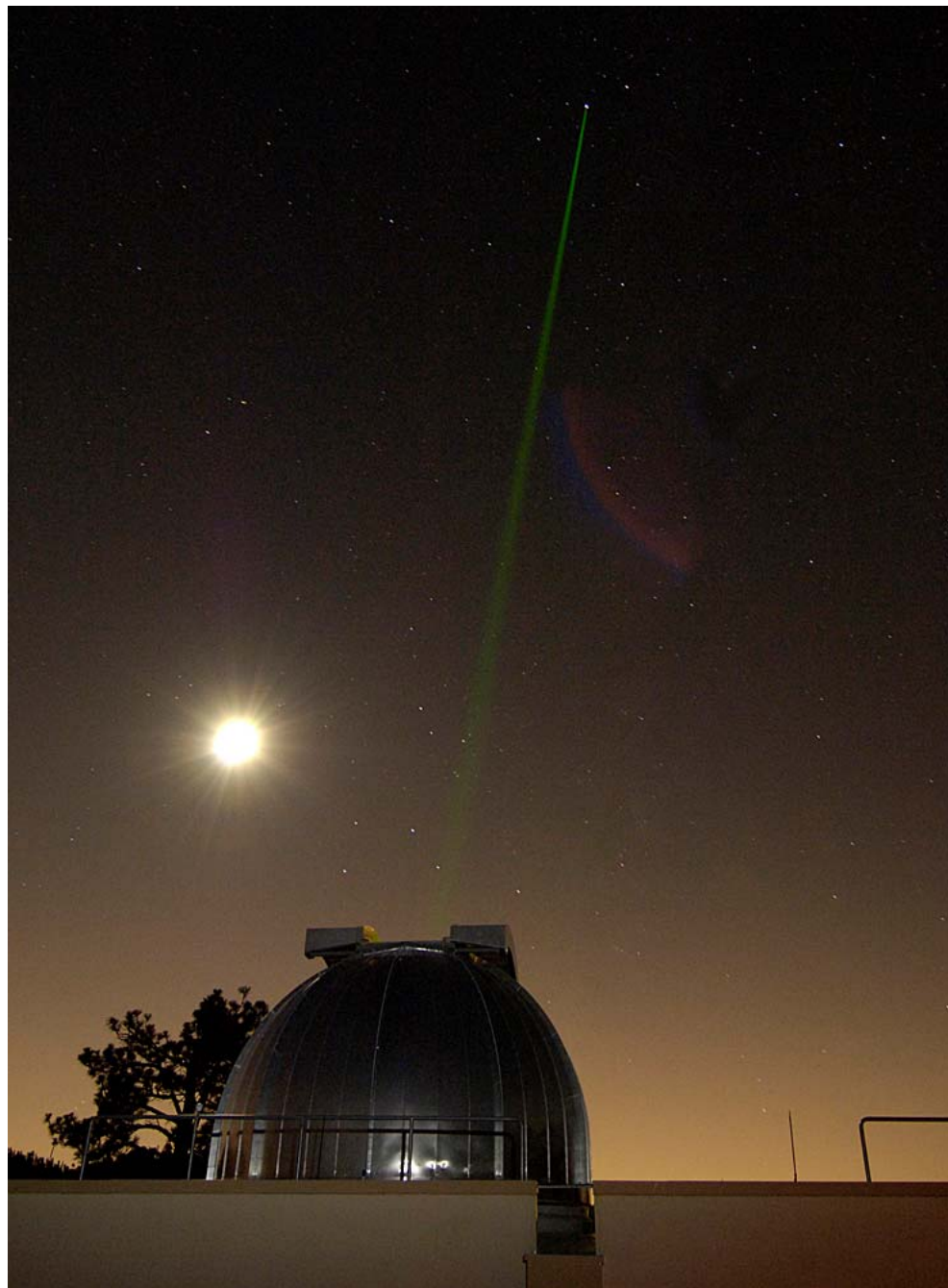
OCTL (Cont'd)

(OPTICAL COMMUNICATIONS TELESCOPE LABORATORY)

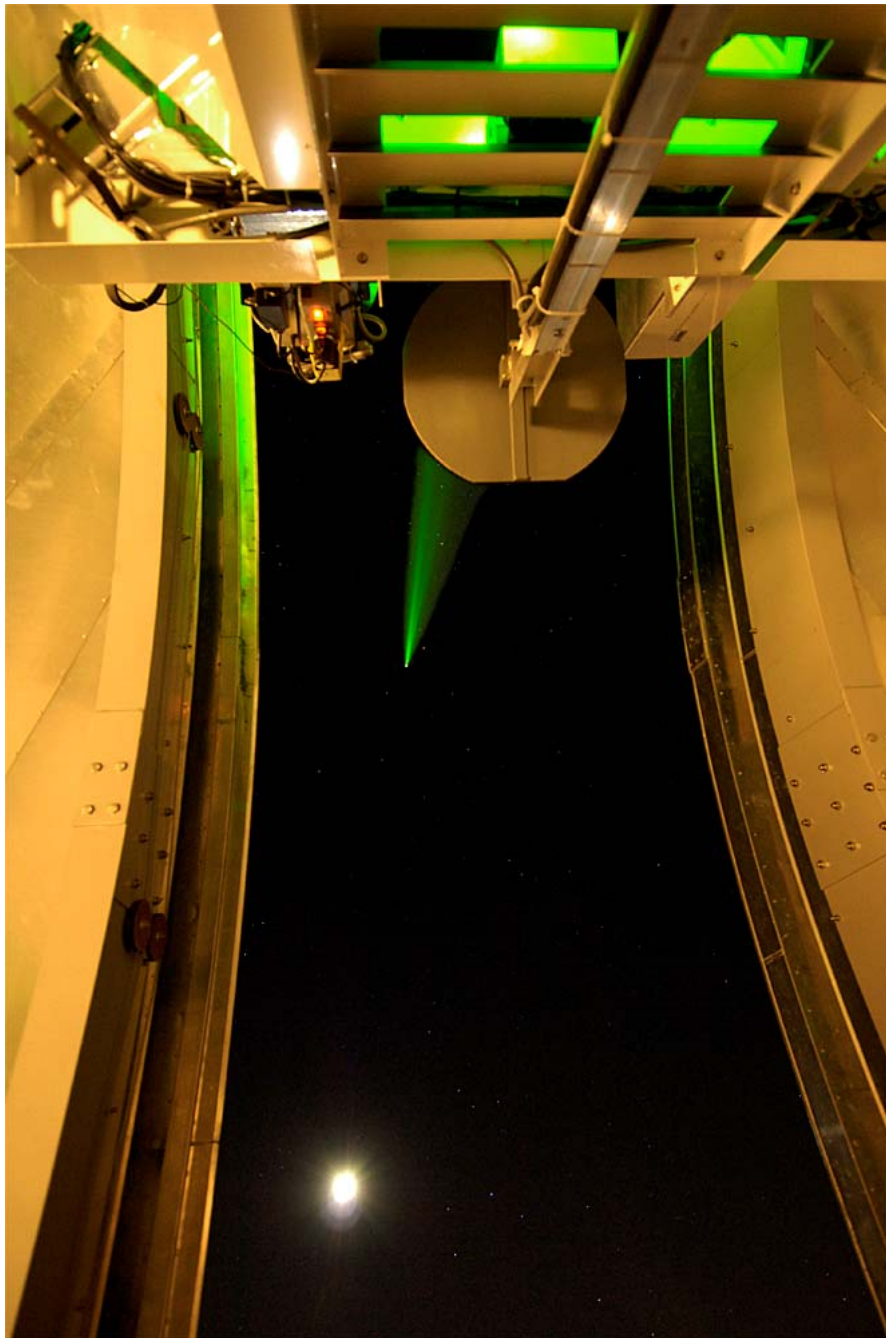
AIRSPACE SAFETY SYSTEM DEVELOPMENT

- Tier-3
 - This is the predictive avoidance to prevent inadvertent illumination of either U.S. or foreign satellites
 - Safe laser beam propagation from the U.S. into space requires that the laser and its site be registered with the U.S. Space Command Laser Clearinghouse (LCH)
 - The registration information includes,
 - Specification of the peak and average laser outputs
 - Laser site location
 - Laser wavelength
 - Laser track across the sky and for the duration of propagation
 - The LCH also requires that operators present proof that they are authorized to illuminate their target satellites
 - The LCH can either issue a blanket approval of transmission at the time of registration or require coordination of all laser beam propagation activity.
 - In the case of unattended remote operation that requires coordination, Tier-3 safety will be implemented by
 - Programming the laser shutter to interrupt the laser beam at those times that the Laser Clearinghouse has precluded transmission
 - This information is transmitted to OCTL from LCH via a time and location specific tracking data file.

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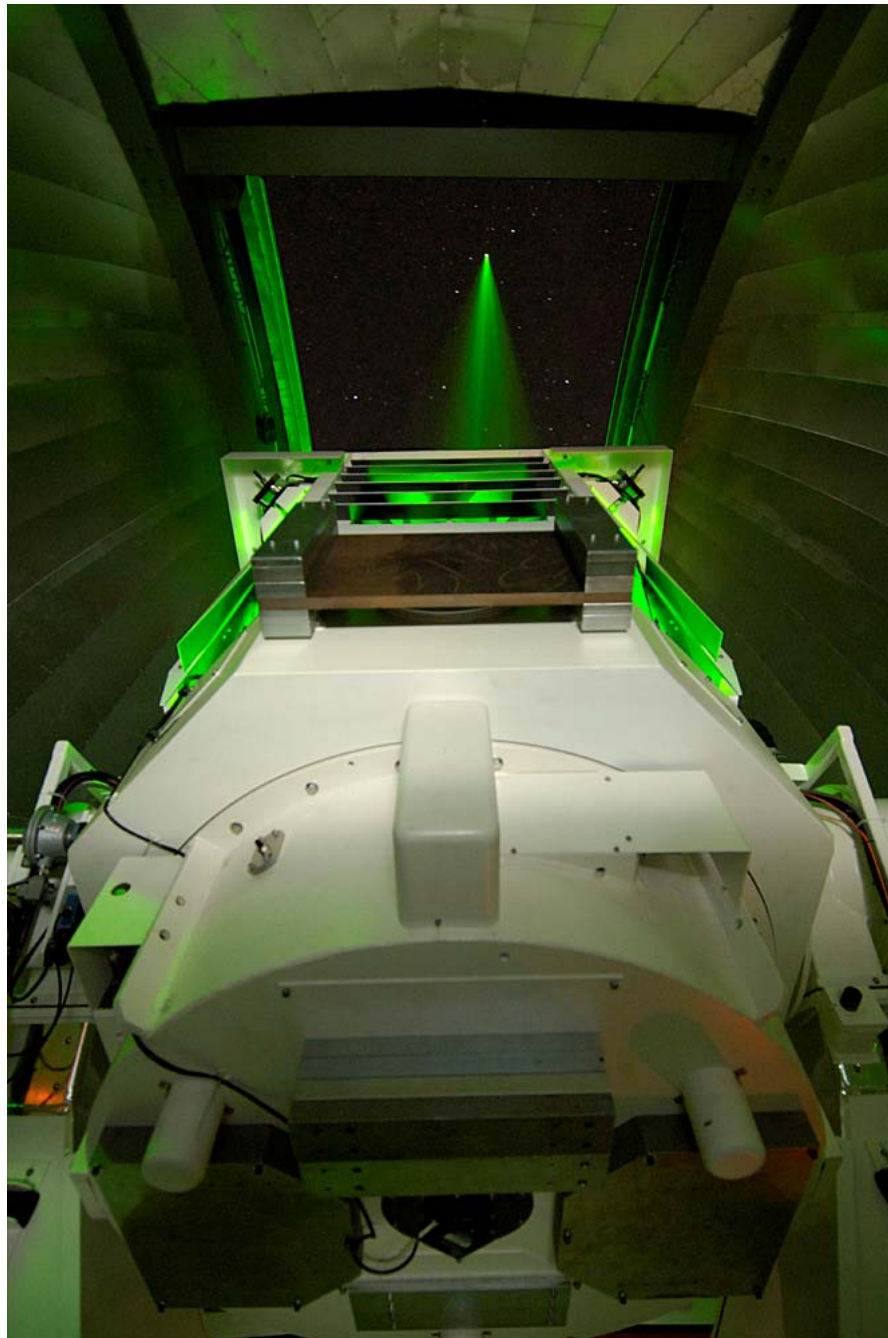


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